

REMARKS

In further support of the claims presented, Applicant submits the following remarks.

I. Prosecution History and Current Status of Claims

Claims 1-59 were originally presented for examination. In the first Office Action: Claims 1-59 stand provisionally rejected under the judicially created doctrine of double patenting over claims in Application Nos. 10/026,020, 10/026,055, and 10/026,016. Claim 1-59 also stand rejected under 35 U.S.C. § 112, second paragraph for being indefinite. Claims 1-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jewell et al. (6,359,920) in view of Eglash et al (5,251,255), and claim 37-59 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jewell et al. (6,359,920) in view of Eglash et al (5,251,255) further in view of Van de Walle et al (5,383,211).

In response to the first Office Action, Applicant has cancelled claim 17 and 18, and has amended claims 1-3, 6-7, 9-13, 16, 20-23, 28, 31, 37-51, and 57. Claim 1-16 and 19-59 remain pending. Applicant believes his amendments to the claims and specification and the following remarks now overcome the rejections and respectfully request reexamination of his application for patent.

III. Provisional rejection under "double patenting" doctrine.

Claims 1-59 stand provisionally rejected under the judicially created doctrine of double patenting over claims 1-44 of co-pending Application number 10/026,020, claims 1-6 of co-pending Application No. 10/026,055, and claims 1-34 of co-pending Application No. 10/026,016. Applicant respectfully traverses the provisional rejection for the following reasons:

First, the present invention, as presented in independent claims 1, 37 and 48, claims an "indium free" VCSEL. All three pending applications cited by Examiner include indium (In) as a material for the quantum well structures being claimed therein. The Applicant will not include In as an element for any claims in the present case. The title of the present invention in

fact clearly describes the focus of the present invention to be for "indium free vertical cavity surface emitting lasers."

Second, all three applications cited by Examiner and the present application were filed by a common inventor, Dr. Ralph Johnson, for a common assignee, Honeywell International, on the same date, December 20, 2001. A double-patenting doctrine rejection seeks to prevent the extension of exclusivity sought by an applicant for an invention by filing subsequent applications covering the same subject matter. Applicant or his assignee cannot extend the term of protection available for its filings of the four associated applications being that each was filed on the same day and will expire twenty years from their filing under current U.S. Patent law.

The double-patenting doctrine also protects a licensee or the public where the lack of notice regarding common inventions may operate to the detriment of the licensee or public when subsequent "related" patents may issue. Applicant has amended the present application to provide notice via any patent that may issue that other related patent applications or patents for the present invention exist. The following notice, which will be entered on the first page of all related applications including the present application, should provide adequate notice:

The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antimony and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,019 entitled "Vertical cavity surface emitting laser including indium and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,020 entitled "Vertical cavity surface emitting laser including indium and antimony in the active region," filed December 20, 2001; and Serial No. 10/026,055. entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 20, 2001.

Applicant believes that his application does not pose a double-patenting issue given the different focus of his invention as provided in claims 1, 37 and 48 when compared to the co-pending applications, because of the common filing date and ownership of the applications, and

because the application has been amended to provide notice regarding the existence of associated applications/patents. For these reasons, Applicant respectfully request withdrawal of the provisional double patenting rejection.

III. Objections Under 35 U.S.C. § 112

Claims 1-59 stand rejected under 35 U.S.C. 112, second paragraph, as begin indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the inventions. Claims 1, 27 and 48 are cited specifically for failing to provide any means, any structure and any structural relationship in order to support the VCSEL in the claims which render the claims confusing, vague and indefinite according the Examiner. Applicant respectfully traverses the rejection.

Applicant has amended Claim 1, 37 and 48. A person skilled in the art of VCSELs understands the basic structure of semiconductor lasers. Applicants claims, when interpreted by those skilled in the art in light of Applicant's detailed specification, *Orthokinetics, Inc. V. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986), sets forth the basic interrelationship between the quantum well, barrier layers and confining layers of a VCSEL device. Applicant's claims set forth the interrelationship of the quantum well, barrier layers and confining layers throughout the detailed specification and the claims apprise one of ordinary skill in the art of their intended scope. All the prior art of record cited by Examiner is also consistent in teaching a well-known and basic VCSEL structure that is generally used by Applicant is describing and claiming his invention. The interrelationship is clearly set forth in Applicant's claims as illustrated in italics and underline below:

1. A vertical cavity surface emitting laser (VCSEL), comprising:  
at least one quantum well having a depth of at least 40 meV, wherein  
said at least one quantum well comprises of material that is free of indium and is  
comprised of GaAsSb;  
barrier layers sandwiching said at least one quantum well; and  
confinement layers sandwiching said barrier layers.

37. A vertical cavity surface emitting laser (VCSEL), comprising:  
at least one indium free quantum well comprised of GaAsSb;  
GaAs barrier layers sandwiching said at least one quantum well; and  
GaAs confinement layers sandwiching said barrier layers.

48. A vertical cavity surface emitting laser (VCSEL), comprising:  
at least one quantum well consisting essentially of GaAsSb;  
GaAs barrier layers sandwiching said at least one quantum well; and  
AlGaAs confinement layers sandwiching said barrier layers.

The United States Patent and Trademark Office has recognized the ongoing concern presented by applicants regarding amendments to applications in light of *Festo Corp. v. Shoketsu Kinzokugyo Co., Ltd.*, 122 S.Ct. 1831, 62 USPQ2d 1705 (2002). The Office has clarified its policy with respect to rejections made under 35 U.S.C. § 112, second paragraph (effective immediately as of January 17, 2003, in a memorandum from Stephen G. Kunin, Deputy Comm. for Patent Examination Policy). According to current policy which will be published in the next revision of the MPEP (§ 2173.02), "during examination of claims for compliance with the requirements for definiteness under 35 U.S.C. §112, second paragraph, some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire." The memorandum goes on to say, "the examiner must consider the claim as a whole to determine whether the claim appraises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. §112, second paragraph by providing clear warning to others as to what constitutes infringement of the patent." (Citing *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000).)

Applicant believes that he has done a good job of setting forth the structural elements and the interrelationship between elements in his claims as evidenced by Examiners use of similar language throughout the 35 U.S.C. § 103 discussion of the Office Action (see page 6, first paragraph, and page 8, paragraph 9, of the Office Action). Applicant's means of setting

forth the structure and interrelationship of the quantum well(s), barrier layers, and confining layers is believed to be clear, simple and intuitive, falls within the scope of the Office's new guidance, and is well supported throughout the detailed specification.

For the foregoing reasons, Applicant respectfully traverses the rejection of his claims under 35 U.S.C. § 112, paragraph 2, as being indefinite.

#### IV. Rejections under 35 U.S.C. § 103(A)

##### Jewell and Eglash

Claims 1-36 stand rejected under 35 U.S.C. § 103(A) as being unpatentable over Jewell et al (6,359,920) in view of Eglash et al (5251,225). Applicant respectfully traverses the rejection.

Applicant respectfully points out to the Examiner before engaging in further discussion of the distinctions between his invention and the cited art that U.S. Patent 6,359,920 was issued on March 19, 2002, which defeats its use as a prior art reference as a basis for the current rejections; however, Applicant is and has become very familiar with the subject matter described by Jewell et al in the patent, as it is a divisional application of U.S. Patent Nos. 5,825,796 and 5,960,018, also issued to Jewell et al. Applicant acknowledges the general subject matter relied on by Examiner in citing the '920 to the extent it is provided in the '796 and '018 patents, which truly predate Applicant's filing of the present invention.

Jewell requires the use of indium (In) within their active region. Eglash also requires the use of indium (In) within their active region. Specifically, Jewell and Eglash use In in their quantum wells. Among other places, the abstract in Eglash describes a laser that "consists of an MBE grown active region formed of a plurality of Ga<sub>1-m</sub>AsSb quantum-well layers separated by AlGaAsSb barrier layers." In the Jewell abstract, the inventors describe the provision of methods "to decrease the peak transition energies of the pseudomorphic *In*GaAs/GaAs heterostructures." (Emphasis added.)

Applicant purposely does not use In anywhere within his claimed invention. Applicant has purposely provided notice in his title that the present invention is directed to an “*Indium free* vertical cavity surface emitting laser.” Applicant has discovered that performance results can be achieved if indium is not used in the development of VCSELs. Specifically, Applicant has learned that devices strain will improve with the removal of In from the material structure of VCSELs. Neither Jewell nor Eglash teach or suggest the development of an “neither indium free’ VCSEL, nor do either reference hint at or suggests that indium be removed from their respective devices. Indium is specifically used in the devices taught by Jewell et al and Eglash et al. Those skilled in the art could not find it obvious from a teach in either reference, alone or in combination, that strain can be improved by not using In as a material component for a VCSEL. Applicant’s has shown several nonobvious benefits that can be achieved by not using In within VCSELS, as basically shown in FIG 8, and/or by adding N (nitrogen) or Sb (antimony) to a indium free device as shown in FIG 10, and/or by adding P (phosphorus) for strain compensation as shown in FIG 11.

Those skilled in the art could not find it obvious from a teaching in these references, alone or in combination, that the benefits outlined above with respect to FIGs 8, 10 and 11, can achieve the favorable results described by Applicant using an indium free structure as set forth in Claims 1 and 27, which are the independent claims for claims 2-26 and 28-25 respectively. Claims 1 and 27 serve as the basis for allowing their respective dependent claims, therefore allowance of Claims 1 and 37 will enable the allowability of their respective dependent claims. For the foregoing reasons, the rejection of Claims 1-36 as being unapentable under Jewell et al and Eglash et al is respectfully traversed.

Jewell, Eglash and Van de Walle

Claims 37-59 stand rejected under 35 U.S.C. § 103(A) as being unpatentable over Jewell et al (6,359,920) in view of Eglash et al (5251,225) and further in view of Van de Walle et al (5,383,211). Applicant respectfully traverses the rejection.

Applicant reminds the Examiner that U.S. Patent 6,359,920 was issued on March 19, 2002.

Van de Walle et al is cited for its disclosure of a quantum well comprising GaAsSbN. The Examiner suggests that it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide Jewell et al and Eglash et al with a quantum well comprising GaAsSbN as taught by Van De Walle et al.

As with Jewell et al and Eglash et al, Van de Walle et al states in its abstract that it is focused on using “[a] semiconductor laser source using a strained active layer of *In*GaAsN,” where the addition of N is shown to produce favorable results. Rather than teaching, suggesting or suggesting the development of an “indium free” device, Van de Walle teaching an opposite approach to developing a VCSEL device. At column 4, line 51, Van de Walle et al provide a further feature of their invention wherein they suggest that “the net strain can be reduced (and the critical layer thickness increased) by adding indium (In) to the alloy.

As before, neither Jewell et al or Eglash et al, and now Van de Walle et al, alone or in any combination, teach or suggest the development of an “indium free” VCSEL, nor do any of these reference hint at or suggests that indium be removed from their respective devices. Indium is specifically used in the devices taught by Jewell et al, Eglash et al and Van de Walle et al. Those skilled in the art could not find it obvious from a teaching in these references, alone or in combination, that the benefits outlined above with respect to FIGs 8, 10 and 11, can achieve the favorable results described by Applicant using an indium free structure as set forth in Claim 48 which is the independent claims for claims 49-59. Claim 48 serves as the basis for allowing dependent claims 47-59, therefore allowance of Claim 48 will enable the allowability of its dependent claims..

For the foregoing reasons, the rejection of Claims 1-36 as being unapertentable under Jewell et al and Eglash et al is respectfully traversed.

V. Conclusion

Applicant has amended claims herein for the purpose of providing additional scope, clarity and some consolidation. The specification was amended to provide a notice of co-pending applications and to correct the citation to a U.S. patent (5,903,588) in the description. No new subject matter has been introduced as a result of this amendment. Attached hereto is a marked-up version of the changes made to the Specification and Claims by the current response, which is captioned "VERSIONS WITH MARKING TO SHOW CHANGES MADE."

In view of the foregoing discussion, Applicant has responded to each and every objection and rejection of the Official Action, and respectfully request that a timely Notice of Allowance be issued. Applicant respectfully submits that the foregoing amendment and discussion does not present new issues for consideration and that no new search is necessitated. Accordingly, Applicant respectfully requests reconsideration of Claims 1-16 and 19-59.

Applicant believes he has demonstrated that his disclosed and claimed invention is novel and non-obvious relative to the prior art. Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned representative to conduct an interview before further written action in an effort to expedite prosecution in connection with the present application.

Respectfully submitted,

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VERSIONS WITH MARKING TO SHOW CHANGES MADE

*In re* Application of : Ralph H. Johnson : Docket No. V637-02671-US  
Serial No. : 10/026,044 : Art Unit No. 2828  
Filing Date : 12/21/98 : Examiner. Tuan M. Nguyen  
Invention Title : Indium free vertical cavity surface emitting laser

IN THE SPECIFICATION:

Please insert the following paragraph on 1 after the Title and the paragraph entitled "TECHNICAL FIELD":

--RELATED APPLICATIONS

The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antimony and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,019 entitled "Vertical cavity surface emitting laser including indium and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,020 entitled "Vertical cavity surface emitting laser including indium and antimony in the active region," filed December 20, 2001; and Serial No. 10/026,055 entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 20, 2001.--

On Page 15, replace the paragraph providing textual reference to Figure 12 with the following paragraph:

--Referring to Figure 12, illustrated is a sectional view of a vertical cavity surface emitting laser 100 (VCSEL). The VCSEL 100 can be grown by techniques such as metal organic molecular beam epitaxy, or metal-organic chemical vapor deposition. Reference is made to U.S. Patent No. ~~5,903,589~~ 5,903,588, assigned to

the assignee for the present invention, which describes methods of VCSEL fabrication use in the art. The VCSEL can preferably be grown on a GaAs substrate 101 due to the robust nature and low cost of the material, however it should be recognized that semiconductor materials, Ge for example, could also be used as the substrate. The VCSEL 100 can then be formed by disposing layers on the substrate.--

IN THE CLAIMS:

Please amend only the claims where indicated below:

1. *(Once amended)* A vertical cavity surface emitting laser (VCSEL), comprising:

at least one quantum well having a depth of at least 40 meV, wherein said at least one quantum well comprises of material that is free of indium and is comprised of GaAsSb;

barrier layers sandwiching said at least one quantum well; and  
confinement layers sandwiching said barrier layers.

2. *(Once amended)* The VCSEL of claim 1 wherein said barrier layers are comprised of ~~GaAsP~~ GaAs and at least one of Al, N and P.

3. *(Once amended)* The VCSEL of claim 2 wherein said confinement layers are comprised of ~~AlGaAs~~ GaAs and at least one of Al, N and P.

4. *(Not amended)* The VCSEL of claim 1 wherein said confinement layers are comprised of AlGaAs.

5. *(Once amended)* The VCSEL of claim 1 wherein said barrier layers are comprised of AlGaAs.

6. (Once amended) The VCSEL of claim 1 wherein said barrier layers are comprised of AlGaAsGaAsP.

7. (Once amended) The VCSEL of claim 1 wherein said at least one quantum well further comprises greater than 1% N.

8. (Once amended) The VCSEL of claim 7 wherein said barrier layers are comprised of GaAsP.

9. (Once amended) The VCSEL of claim 7 wherein said confinement layers are comprised of AlGaAs and said barrier layers are comprised of GaAsN.

10. (Once amended) The VCSEL of claim 7 wherein said confinement layers are comprised of AlGaAs and said barrier layers are comprised of GaAsN.

11. (Once amended) The VCSEL of claim 9 wherein said barrier layers are comprised of AlGaAsGaAsN.

12. (Once amended) The VCSEL of claim 7 wherein said barrier layers are comprised of AlGaAs GaAsN and said confinement layers are GaAsP.

13. (Once amended) The VCSEL of claim 14 wherein said at least one quantum well comprises >1% N added to the quantum well(s).

14. (Not amended) The VCSEL of claim 1 wherein said barrier layers are comprised of GaAsP.

15. (Not amended) The VCSEL of claim 1 wherein said confinement layers are comprised of AlGaAs.

16. (*Once amended*) The VCSEL of claim 14~~1~~ wherein said confinement layers are comprised of AlGaAs.

17. CANCELLED

18. CANCELLED

19. (*Not amended*) The VCSEL of claim 1 wherein said quantum well is up to and including 50Å in thickness.

20. (*Once amended*) The VCSEL of claim 19 wherein said barrier layers are comprised of ~~GaAsP~~GaAs and at least one of Al, N and P.

21. (*Once amended*) The VCSEL of claim 20~~19~~ wherein said confinement layers are comprised of ~~AlGaAs~~GaAs and at least one of Al, N and P.

22. (*Once amended*)The VCSEL of claim 19 wherein said confinement layers are comprised of AlGaAs and said barrier layers are comprised of GaAsP.

23. (*Once amended*)The VCSEL of claim 22~~19~~ wherein said barrier layers are comprised of AlGaAs and said confinement layers are comprised of GaAsP.

24. (*Not amended*) The VCSEL of claim 19 wherein said barrier layers are comprised of AlGaAs.

25. (*Not amended*) The VCSEL of claim 19 wherein said at least one quantum well comprises N.

26. (Not amended) The VCSEL of claim 25 wherein said barrier layers are comprised of GaAsP.

27. (Not amended) The VCSEL of claim 25 wherein said confinement layers are comprised of AlGaAs.

28. (Once amended) The VCSEL of claim 626 wherein said confinement layers are comprised of AlGaAs.

29. (Not amended) The VCSEL of claim 27 wherein said barrier layers are comprised of AlGaAs.

30. (Not amended) The VCSEL of claim 25 wherein said barrier layers are comprised of AlGaAs.

31. (Once amended) The VCSEL of claim 19 wherein said at least one quantum well comprises >1% Nadded to the quantum well(s).

32. (Not amended) The VCSEL of claim 31 wherein said barrier layers are comprised of GaAsP.

33. (Not amended) The VCSEL of claim 31 wherein said confinement layers are comprised of AlGaAs.

34. (Not amended) The VCSEL of claim 32 wherein said confinement layers are comprised of AlGaAs.

35. (Not amended) The VCSEL of claim 33 wherein said barrier layers are comprised of AlGaAs.

36. (Not amended) The VCSEL of claim 31 wherein said barrier layers are comprised of AlGaAs.

37. (Once amended) A vertical cavity surface emitting laser (VCSEL), comprising:

at least one indium free quantum well comprised of ~~GaAsSbN~~ GaAsSb; GaAs barrier layers sandwiching said at least one quantum well; and GaAs confinement layers sandwiching said barrier layers.

38. (Once amended) The VCSEL of claim 37 wherein said barrier layers are comprised of ~~GaAsP~~ GaAs and at least one of Sb, N, Al, P.

39. (Once amended) The VCSEL of claim ~~20~~37 wherein said confinement layers are comprised of ~~AlGaAs~~ GaAs and at least one of Sb, N, Al, P.

40. (Once amended) The VCSEL of claim ~~49~~37 wherein said confinement layers are comprised of AlGaAs and said barrier layers are comprised of GaAsN.

41. (Once amended) The VCSEL of claim ~~22~~37 wherein said barrier layers are comprised of AlGaAs and said confinement layers are comprised of GaAsP.

42. (Once amended) The VCSEL of claim ~~49~~37 wherein said barrier layers are comprised of AlGaAs.

43. (Once amended) The VCSEL of claim ~~49~~37 wherein said at least one quantum well further comprises >1% N ~~added to the quantum well(s)~~.

44. (Once amended) The VCSEL of claim ~~25~~43 wherein said barrier layers are comprised of GaAsP.

45. (Once amended) The VCSEL of claim 2543 wherein said confinement layers are comprised of AlGaAs.

46. (Once amended) The VCSEL of claim 2644 wherein said confinement layers are comprised of AlGaAs.

47. (Once amended) The VCSEL of claim 737 wherein said quantum well is up to and including 50 Å in thickness.

48. (Once amended) A vertical cavity surface emitting laser (VCSEL), comprising:

at least one quantum well ~~comprised~~consisting essentially of GaAsSbNGaAsSb;

GaAs barrier layers sandwiching said at least one quantum well; and  
AlGaAs confinement layers sandwiching said barrier layers.

49. (Once amended) The VCSEL of claim 48 wherein said barrier layers are further comprised of GaAsP.

50. (Once amended) The VCSEL of claim 48 wherein said barrier layers are further comprised of AlGaAsGaAsN.

51. (Once amended) The VCSEL of claim 48 wherein said at least one quantum well further comprises >1% N ~~added to the quantum well(s)~~.

52. (Not amended) The VCSEL of claim 51 wherein said barrier layers are comprised of GaAsP.

53. (Not amended) The VCSEL of claim 51 wherein said barrier layers are comprised of AlGaAs.

54. (*Not amended*) The VCSEL of claim 48 wherein said quantum well is up to and including 50 Å in thickness.

55. (*Not amended*) The VCSEL of claim 54 wherein said barrier layers are comprised of GaAsP.

56. (*Not amended*) The VCSEL of claim 54 wherein said barrier layers are comprised of AlGaAs.

57. (*Once amended*) The VCSEL of claim 54 wherein said at least one quantum well further comprises >1% N added to the quantum well(s).